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# ONRREUR Report

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AD-A213 929



BRITE-EURAM 1989

J.F. Blackburn

31 July 1989



Office of Naval Research European Office

89 10 27 161

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE

# REPORT DOCUMENTATION PAGE

| | |
|---|---|
| 1a REPORT SECURITY CLASSIFICATION<br>UNCLASSIFIED | 1b RESTRICTIVE MARKINGS |
| 2a SECURITY CLASSIFICATION AUTHORITY | 3 DISTRIBUTION / AVAILABILITY OF REPORT<br>Approved for public release;<br>distribution unlimited |
| 2b DECLASSIFICATION / DOWNGRADING SCHEDULE | |
| 4 PERFORMING ORGANIZATION REPORT NUMBER(S)<br>9-9-C | 5 MONITORING ORGANIZATION REPORT NUMBER(S) |
| 6a NAME OF PERFORMING ORGANIZATION<br>Office of Naval Research<br>European Office<br>6b OFFICE SYMBOL (If applicable)<br>(ONREUR) | 7a NAME OF MONITORING ORGANIZATION |
| 6c ADDRESS (City, State, and ZIP Code)<br>Box 39<br>FPO, NY 09510-0700 | 7b ADDRESS (City, State, and ZIP Code) |
| 8a NAME OF FUNDING / SPONSORING ORGANIZATION<br>8b OFFICE SYMBOL (If applicable) | 9 PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER |
| 8c ADDRESS (City, State, and ZIP Code) | 10 SOURCE OF FUNDING NUMBERS<br>PROGRAM ELEMENT NO / PROJECT NO / TASK NO / WORK UNIT ACCESSION NO |

11 TITLE (Include Security Classification)

BRITE-EURAM 1989

12 PERSONAL AUTHOR(S)

J.F. Blackburn

| 13a TYPE OF REPORT | 13b TIME COVERED | 14 DATE OF REPORT (Year, Month, Day) | 15 PAGE COUNT |
|---|---|---|---|
| Conference | FROM ______ TO ______ | 31 July 1989 | 8 |

16 SUPPLEMENTARY NOTATION

| 17 COSATI CODES | | | 18 SUBJECT TERMS (Continue on reverse if necessary and identify by block number) |
|---|---|---|---|
| FIELD | GROUP | SUB-GROUP | Computer Communications, Computer Logic, Computer Architecture |
| 12 | 06 | | |
| | 07 | | |

19 ABSTRACT (Continue on reverse if necessary and identify by block number)

The second Basic Research in Industrial Technologies for Europe-Europe/America (BRITE-EURAM) conference was held in Brussels, ~~Belgium~~, in winter 1989. The primary objective of the program is to make European manufacturing industries more competitive in world markets. The four major technical areas are: (1) advanced materials technologies; (2) design methodology and assurance for products and processes; (3) applications of manufacturing technology, and (4) technologies for manufacturing processes, each with several subareas.

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|---|---|
| 20 DISTRIBUTION / AVAILABILITY OF ABSTRACT<br>☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT ☐ DTIC USERS | 21 ABSTRACT SECURITY CLASSIFICATION<br>UNCLASSIFIED |
| 22a NAME OF RESPONSIBLE INDIVIDUAL<br>Ms. Connie R. Orendorf | 22b TELEPHONE (Include Area Code)<br>(44-1) 409-4340<br>22c OFFICE SYMBOL<br>310 |

DD FORM 1473, 84 MAR

83 APR edition may be used until exhausted
All other editions are obsolete

SECURITY CLASSIFICATION OF THIS PAGE

U.S. Government Printing Office: 1986—607-0

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# Contents

# BRITE-EURAM 1989

## Introduction

The second Basic Research in Industrial Technologies for Europe-Europe/America (BRITE-EURAM) conference, January 31- February 2, 1989, held in Brussels, Belgium was attended by about 1,200 delegates from the 12 European Community (Community) countries. It opened with a plenary session on the morning of January 31 and the subsequent two and one half days were devoted to three parallel sessions.

This report summarizes the plenary session talks and those parallel sessions that I attended.

## Plenary Session

### Opening Address

Mr. Pandolfi, Vice President, The European Commission (Commission).

The BRITE-EURAM technological days and the European Strategic Program for Research and Development in Information Technologies (ESPRIT) week are the two most regular opportunities in the calendar for Community research and development (R&D) activities to be presented and discussed by researchers from across the Community. Almost 1,200 people are here for the presentation of the BRITE and EURAM projects. Our success depends on your project and the results you are achieving.

The working session titles show clearly that you have achieved real progress across the whole spectrum of industrially relevant R&D--from the development and application of materials, to the technology needed to assure design and quality of products, the application of manufacturing systems. Interesting and pertinent projects range from materials development of relevance to the construction and automobile industries, to the development of new sensors to control manufacturing processes; to projects in the field of lasers, as well as those directed to traditional manufacturing such as textiles and clothing.

However, your results must be exploited and translated as soon as possible into products and services for the market. It is heartening to learn that a large number of participants in BRITE projects have recently reported that they expect to realize commercial benefits from their projects within 5 years.

I wonder whether the Community can do more. The Single European Act charges us with the duty of contributing toward the competitiveness of the Community economy. This can be achieved only if the transition from R&D to market is widely and effectively assured.

We are helping through the "Value" and Strategic Program for Innovation and Technology Transfer (SPRINT) programs and we have been running successful demonstration programs in energy for about 10 years. (Note: Value - Program for the dissemination and use of results from research in science and technology [S&T]). Is this all that needs to be done?

The road from R&D to the market passes through applied R&D, feasibility studies, pilot projects, and demonstration of technical and commercial viability. There may be scope for new Community actions in this area. However, we must look at the relationship between the Community programs and the European Research Coordination Agency (EUREKA) venture, which has an orientation closer to the market than do Community programs. Already there are examples of BRITE projects that have been exploited in EUREKA.

Creating a strong set of links between different frameworks for European cooperation must be an important element in ensuring that Community R&D resources are used to the best effect.

### The Relevance of European Community R&D Program for Industrial Development

Mr. M. Guasch-Molins, President, Renault-Fasa, Madrid.

Community markets are exceptionally open to outside competitors, the import penetration of Community markets is 13 percent for industrial products, compared with 11 percent for the U.S. and 5 percent for Japan. To some extent, we have been the architects of our own problem.

Investment rates in European industry have been declining. From 1972-1980, industrial investment increased 5 times faster in Japan and 10 times faster in the U.S. The stagnation of industrial investment in Europe is most marked in computers and office equipment, electrical and electronic goods, chemicals, and pharmaceutical products. We have lost market share in the fast expanding sectors and gained in the more slowly growing sectors. This has led to higher market penetration by outsiders.

The Community possesses significant technological resources. In 1980, R&D expenditures by member states totalled some 70 billion ECUs and involved more than 500,000 researchers.

However, Europe is slow in incorporating the results of technological progress. The problem of European industry may be as much related to difficulties in industrial innovation as they are to investment in technology.

Dr. Blackburn is the London Representative of the Commerce Department for Industrial Assessment in Computer Science and Telecommunications.

A composite measure of innovativeness developed by the European Management Forum – innovative forward orientation – ranked Japan and the U.S. first and second, respectively, among the 22 Organization for Economic Cooperation Development (OECD) countries in 1985. Although the U.S. slipped to 5th in 1986, only Germany ranked ahead in 4th position. For example, France ranked 12th, Ireland 17th, and Spain 20th.

However, Europe is fighting back. The textile and the automotive sectors have been radically improved through automation and product innovation. In automobiles, new materials are making a major impact, especially plastics, composites, aluminum, and high strength low alloy steels. Between 1980 and 1987, productivity in autos increased by more than 30 percent. Even so, Europe is barely maintaining its position in the industry.

As we prepare for 1992, the task of improving the technological and innovative performance of European industry must be tackled with new policies and renewed vigor.

The Community's R&D programs, now incorporated on the second Framework Programme, have grown to an approximate annual expenditure of one billion ECU. There are three types of Community R&D initiatives – industry oriented (BRITE, ESPRIT, EURAM); public interest (health, environment); and agriculture.

The industry oriented initiatives amount to about half of the total budget of the Framework Programme; i.e., about 2.6 billion ECU over the 5 years of the program. This industrial orientation evolved in the 1980's in direct response to the perceived U.S. and Japanese threat. The European Act recently strengthened the scientific and technological basis of European industry to encourage cooperative efforts between industry and research centers and universities.

However, industrially oriented R&D in the Framework Programme is no more than two percent of member states own expenditure on industrial R&D. In preparing for 1992, the Commission needs much stronger financial leverage, and therefore an expanded Framework Programme. Also, the share of the program relevant to industrial matters seems too small; the reallocation of resources is urgently required.

Another question we must consider is whether the predominantly precompetitive nature of Community initiatives is the right approach. Links established through Community collaboration in R&D are valued by firms but these links tend to be a by-product rather than the prime objective of the program. Perhaps these linkages should be more fully facilitated. We might consider the models of either the Japanese approach toward facilitating the formation of consortia or the EUREKA approach of minimal intervention. Or could the SPRINT be a model that might be expanded or modified?

We should also decide whether total adherence to the excellence criterion in choosing which proposal to fund might place the less developed regions at a further disadvantage and accelerate the concentration of technological power in a few strong central locations in Europe. This could be detrimental. The Commission, considering this issue, has proposed Science and Technology for Regional Innovation and Development in Europe (STRIDE).

On the matter of industrial impact of Community R&D the following points are relevant:

- Eighty-five percent of contractors believe that they could not have undertaken the same project without Community support
- The program has created new industrial alliances and consortia in Europe
- Industrial participants in BRITE expect to obtain a commercial payoff from the research.

However, there have been some problems. It is apparent that there is a gap between corporate management and technical management in many participating companies. Technology is not always regarded as a strategic variable in company planning and this results in weak innovation management.

A second gap relates to diffusion of the technology generated in programs such as BRITE to a wider spectrum of industry. The Community needs a stronger technology transfer effort. We also need to distinguish between the will and the capacity to innovate. Perhaps more training in management of technological resources in companies is needed.

Other programs of major industrial interest are EURAM (now BRITE-EURAM), biotechnology, ESPRIT, and R&D in Advanced Communications Technologies in Europe (RACE).

The EURAM has been an advanced materials effort mainly involving universities and research establishments. Many projects do not involve industrial participation and average less than 300,000 ECUs each. With the reorganized BRITE-EURAM, participation by industry should increase.

The biology programs have been very small projects, averaging 50,000 ECUs/year. Very few firms have participated.

The energy field, not in the Framework Programme, is one of the major Community initiatives in demonstrating new technologies. It has been in operation since 1978 and has been funded by about 900 million ECUs, with industry the main beneficiary. In addition, the Community has funded about 340 million ECUs of energy research. However, the energy program has not made a significant impact on energy supply and demand in Europe.

The ESPRIT program is the largest single program of the Framework, amounting to 1.6 billion ECUs. More than half the projects in ESPRIT are led by the large Information Technology (IT) companies, but small companies have had a prime contractor role in about 20 percent. The popularity of the program with industry is immense.

A study has recommended that in Ireland the Commission should be more concerned with raising the baseline of S&T capacity rather than with pushing out the frontiers of science. The study noted that in Denmark the biggest benefit has been the resulting internationalization of Danish research. The Danish study, like others, found that participation in Community research programs is highly valued by the contractors. However, the number of contractors is very limited.

In Greece, the BRITE program is the most successful Community program.

Spain will benefit greatly from participation in Community R&D programs, especially if supplemented by the proposed STRIDE measures. In Spain in 1986, a new law for the global coordination and promotion of S&T was passed, with the aim being a complete restructuring of systems for implementing national and regional S&T policies.

One of the key planks in Spanish S&T policy is the encouragement of international cooperation in S&T and the promotion of appropriate linkages of foreign technologies with the indigenous capabilities of Spanish industry.

Finally, I would envisage for the future an expanded Community R&D effort with a stronger degree of Commission leverage on national efforts, together with a greater involvement of the production and marketing sides of industry in establishing priorities.

### Setting R&D Priorities for an Industrial Company

Mr. N.B. Smith, Chairman MB Group, UK.

I shall give a personal view of factors needed for the success of an industrial company. I spent 30 years with Imperial Chemical Industries (ICI) specializing in the market for synthetic fibers. Currently, I am with a company that produces packaging materials.

Let us first ask what is the purpose of research? There are scientific reasons for determining the source of knowledge. Another reason is to protect the environment as we live in a finite world with dangers to limited resources. I'll concentrate mainly on industrial research, which helps determine the future health and success of an industrial enterprise. Research must be seen as an ingredient necessary for success. If a firm has the wrong objectives, the result can be the end of industrial research and, ultimately, of the business. A business must know where it is and where it is going. Research must find its proper place in the business.

How should a company define its destiny? It must have a realistic awareness of competitive changes, both technical and strategic. It is now possible for competition to emerge from almost any quarter. A company must realize that having a leading position in its own technology is not enough to ensure success. Customers must be courted and the product must be promoted. Quality, price, service, and satisfaction are measured through the customer.

The company must use all available resources including people and production development and control. The vendor needs to know his customer's business and how his needs are changing. Those who excel in this respect will be the winners of the future.

The people running production operations are normally under pressure and they need help from management. It is satisfying to reflect success but the business must have demanding technical objectives. There is often a conflict between short term pragmatism and long term vision. Vision and courage are needed for the long term growth and survival of a business.

A proper view of marketing is that of harnessing the total resources of the business to attain the entire market objectives. Business must project itself and show its worth to customers. Technical competence should be accepted as a matter of fact. The R&D operation must join in the battle and the be prepared to market itself.

In organizing the R&D group, consideration must be given to the range of products, and the geographical dispersion. The operation should be divided into small units and each unit should be challenged to know the markets and customers.

Packaging today means more than providing a container – it promotes the product.

There is a distinct advantage in having a central research resource. It is able to look outward, carry on collaborative work, and share risks and rewards for the common benefit.

Some achievements of my company include lower costs of production and better plastic packaging. We continue to reassess our situation to meet new challenges. The market is turbulent, but out of turbulence comes opportunity.

### Customers, Suppliers, and Researchers: The Opportunities and Pitfalls in Europe for R&D Collaboration

Mr. N. Foss, Chairman, Foss Electric, Denmark.

I shall begin with some experiences concerning collaboration between research and industry. I shall then turn to customer collaboration and finally make some remarks about chemical suppliers of raw materials and the paint industry.

Collaboration between research and industry includes collaboration between an industrial business and national as well as foreign research environments. This requires a systematic analysis of world-wide research results.

The following case relates to a new instrument marketed today by Foss Electric. About 10 years ago, interest in microbiological rapid test methods arose within scientific circles. Foss Electric initiated a feasibility study on the bacteriological content in raw milk. In 1979, we began collaboration with a research group in Scotland on the development of a new product concept, which would make possible automatic measurement of the bacteriological content in milk within 3 minutes against a manual

standard method that takes 3 days. After a time, the collaboration ran into great difficulties because of different priorities and technical disagreements. A new collaboration was started with a German University and the work progressed better partially because Foss had learned to point out the contents and limits of the research group's efforts. In the final stage, the university participated in a very intensive test of the instrument, which revealed its possibilities and its limits. A subsequent project optimized the technology and resulted in an instrument that was introduced to the market in 1988.

I believe that R&D collaboration with researchers is of interest mainly in the initial and final phases of a development project. Such collaboration is of less interest in the intermediate phase of a project because

- Research people often have expert knowledge within specific field, but they represent technologically limited view points
- Researchers have the attitude that consumption of resources and observance of plans are less important than a complete recognition of the possibilities and limits of the technology they want to use.

It is essential to recognize the key role of management of the resources and plans.

Many new project ideas are born in research environments. However, the collaboration on developing a research based product idea encounters a number of difficulties; e.g.,

- The researchers' evaluation of the value of the product is often completely unrealistic. I believe that the difference in the evaluation of the profitability of a product idea is frequently the reason for making it impossible to collaborate
- The research group has a professional interest in an early publication of results. The industrial business has to make a feasibility study, then evaluate the concept and finally apply for a patent before publishing.

However, a well planned team can work and the combination of several known technologies will be increasingly important.

Some pitfalls to observe in collaboration in high technology are

- The know-how of the research group is often highly specialized, but they may not understand cost and application
- In many cases, the business culture deviates from the research institution culture. Terminology differences may even be an obstacle.

However, where there is a successful collaboration between industry and research up to the market introduction, the industry could create faster acceptance of the new product and technology.

In summary, the benefits from close R&D cooperation between research and industry offer the opportunity to become the technology leader; have access to scientific results and methods; have access to special equipment and facilities; and, obtain faster approval and acceptance.

However, the pitfalls include unrealistic research opinion of the value of innovation, when to publish, and difference in corporate culture.

In working with customers, the company can also gain important benefits; e.g., working closely with lead users, who are often technically very able, produces results in innovative, state-of-the-art products that are well received in the market.

The pitfalls in this case include listening to the wrong users who are not qualified, need may be too specific to a single customer, and users gain access to information that may leak to competition.

Working with suppliers may have advantage; e.g., give an edge on competitors more fully on target for the manufacturer and access to special equipment.

But, there are pitfalls; e.g., leak of information to competitors, dependence on one supplier, supplier may only want information for himself, and trends may be realized sooner by competition.

## Parallel Sessions

### Introduction of Stability and Plasticity Phenomena into a Computer-Aided Design Project for Metallic Structures

V de Ville de Goyet, University of Liege, Belgium.

The aim of this project is to introduce instability and plasticity in the design and analysis of steel structure. At Liege, a nonlinear finite element program has been written by researchers during their Ph.D. theses. The BRITE program was aimed at making the program available for industrial purposes, particulary small and medium sized companies, by implementing the computation capabilities and offering it as a user friendly program.

The program, called FINELG, can predict the actual behavior of structures, taking account of plasticity, instability phenomena, residual stresses, and initial geometrical imperfections. Some advantages resulting from the numerical simulation are

- Collapse load of the structure can be predicted accurately
- Behavior and the safety margin can be studied and understood
- Valuable parametric studies are possible
- Design rules for engineers can be determined
- Numerical simulations can be substituted for difficult scale experiments.

In parallel with the programming work at the university, the computer program will be used by industrial partners for parametric studies of typical complex structures, previously designed by empirical methods.

### Predictive Techniques for the Analysis and Design of Fiber Reinforced Composite Materials and Structures Capable of Withstanding Impulsive Loading

C. Saint John, Principia Mechanica, UK.

This R&D program is to produce a development and mathematical modeling technique for simulating the highly nonlinear behavior of composites under impulsive loadings. Such loads cause extreme stresses in the material, leading to fracture, delamination, penetration, and other complex phenomena. The program will develop constitutive models that define deformation and damage as a function of stress level, strain rate, and material parameters. These models will be incorporated within a predictive tool developed to simulate the behavior of selective composites under impulsive loading. The work involves establishing a database containing the material property and manufacturing information for the composites. These include polyethylene and kevlar laminates and other materials. Testing is carried out on small samples and components, including helmets, and aircraft wings, and hulls. Testing at relatively low velocities is underway, with attention being given to establishing appropriate instrumentation and standard post test characterization methods. Subsequent testing will use single and two-stage gas guns to launch impactors at velocities of up to 5km/s. These two gas guns have been fabricated and are being installed.

### Development of Standardized Material Transport Devices for the Sequential Automation of the Processing of Flexible Materials

R. Haug, Pfaff Gmbh, Germany.

The project will develop a new technical handling solution for flexible material; e.g., the garment industry, using the freezing principle. Also, it will develop standardized material transport devices which in combination realize varied sequential automation solutions. An evaluation device with linkable handling modules will be developed as a prototype for a task sequence with three sewing operations.

Comprehensive product and process analyses enabled operational handling modules to be determined that require special technical solutions. Numerous modules were designed and developed step by step and realized within the entire concept. The modules will be included in material transport systems for the sewing industry as an integrated part with flexible operation. Automation of the actual sewing process is the initial point of development. Another effort was the application of the frozen gripper idea. In this system, gripping and holding of pattern parts is ensured without any material adjustment setting. The possibility of miniature dimensions of the frozen gripper leads to expectation of universal and promising use as handling equipment.

### Two- and Three-Dimensional Garment Modeling

M. Hustin, CIG Industry Systems and Services, Belgium.

The project will improve current design and production techniques by CAD/CAM. Such technology can lead to a breakthrough in the conventional design process in the garment industry if the knowledge of the designer can be translated into a form suitable for input into a computer. The results of the project will lead to shortening of the design process and an improvement in the quality of the process and product.

After 2 years, a prototype has been developed with the following capabilities:

- Create the 3-D base surface
- Create new elements simultaneously in the 2-D model and on the 3-D surface
- Visualize the created model
- Transfer the design to a 2-D modeling and grading system.

### Sensor Technologies for Machine Control and Condition Monitoring

E.D. Stein, GEC Marconi, UK.

This project will develop sensors and signal conditioning electronics which can be built into machines to allow monitoring and control at low cost. Work includes development of material technologies and of signal enhancement methods.

A number of materials technologies have been investigated to produce hybrid sensors. A hybrid sensor is a device that generally consists of sensing/transducing elements and conditioning/processing electronics packaged as a integral unit.

A prototype optically-addressed vibrometer has been built that has shown an acceleration response flat to ±2dB over the frequency range 100 to 750 Hz. Level sensors capable of transmitting and receiving ultrasonic signals have also been manufactured and have generated ultrasonic echo signatures for several test objects.

The primary goal of the signal processing has been object recognition. Digital signal processors have been used to develop techniques for deconvolution of ultrasonic echo profiles.

A Fourior transform algorithm has been implanted on an A 100 digital signal processor/transputer system. This has allowed parallel processing of test data and gives the ability to reconstruct object shape, and thereby provide object recognition in real time.

### Optical Sensors and Fiber Optic Wavelength Division Multiplexing for Process Control

M.G. Anglaret, Fromatome-Optofra, France.

Wavelength division multiplexing (WDM) combined with multimode optical fiber are being applied to diverse areas of process control. This project will

- Extend the use of such systems to the acquisition and transmission over several hundred meters of signals delivered by optical or optically-operated sensors measuring pressure, temperature, level, flowrate, and displacement by improving the power budget, identi-fying influence parameters, and compensating for them.
- Develop sensors and optoelectronics compatible with the WDM system by the following:
  * Engineer simple analog devices with appropriate referencing and compensation
  * Design novel optical microtransducers using silicon microengineering technology to develop
  * Design fiber optic sensors based on luminescence decay time.

### Adaptive Control of Laser Processing

I.J. Spalding, United Kingdom Atomic Energy Administration (UKAEA), Culham Laboratory, UK.

The main objective is to demonstrate reliable and repeatable straightline joining of 12mm- and 25mm-thick mild steel plates in sizes up to 6 meters long, using single-sided *fillet* welding in a T-butt geometry. Ancillary goals include

- Analyzing laser beam characteristics/process correlations
- Process monitoring, including automated feeding of filler wire, and online scanning of the weld gap using a vision system
- Controlling deep penetration weld phenomena.

Some highlights of achievement after 2 years of a 3-year project:

- Significant differences have been measured in the focal intensity fluctuations generated by three different commercial lasers. Each was DC-excited and exhibited stable long term power output. At the high powers generated by a linearly-polarized transverse-flow system, dramatic changes in polarization, with fluctuations to 20 percent in the orthogonal polarization, have been correlated with the welding conditions. Means for suppressing such fluctuations have been demonstrated successfully. The ultimate objective of such work is to understand and control factors influencing process quality.
- Suitable wire-feed, beam focus, and other conditions have been established for the successful double-pass welding of 25mm plate at speeds of about 5mm/sec. As anticipated, online weld monitoring techniques have proven much more demanding than the offline methods successfully demonstrated earlier. However, an ultrasonic monitoring technique has shown promise as a "lack-of-penetration monitor." This warrants a detailed investigation for online penetration monitoring and adaptive control of any changes occurring on time scales of 1/2 second or longer for plate thicknesses of 12-25mm.
- A standard *Seam pilot* vision system from Oldoft provides adequate response for single axis laser welding at speeds up to 50mm/sec without further modification or development.
- An adequately stiff (3 axis) gantry having a working stroke of 6 meters along its length has been specified by Culham, mechanically designed and constructed, and installed at Culham within a suitable laser-safety enclosure. Extensive optical design work, validated using 10 kW beam-transmission measurements over the working flight paths of 13 $\pm 3$ meters, has been completed by Culham, together with a laser pointing servo-mirror control system. The latter has a frequency response 5Hz and an accuracy of $\pm 50$ microradions, corresponding to $\pm 0.025$mm at the weld, for a slow rate of 1 Mrad/sec. Also, the three control motors providing linear 6 meter and vertical focus movement, together with a rotary transverse weld-line adjustment, have been commissioned with open-loop control.
- Laser-textured and transformation-hardened 3-D metal moulds have been successfully used to produce a variety of surface textured plastic components.

## Plenary Session

### Links Between R&D and Standardization

B. Vancelle, Director General, Agence Francais de Normalization (AFNOR), France.

Invention is the essential part of research. Some characteristics of standardization are

- Accepted common language
- Can be national, international, or regional
- Can create a European system
- Find and exploit the right standard leading to market share gain
- Use as a tool for competitivity and industrial strategy.

In BRITE-EURAM, only some results will be standard. Some generally accepted ideas are that the market is based on the thinking of the 1960s and 1970s. The modern standardization trend is toward current needs. Key ideas are needed for products and for their marketing.

Innovation is needed to create and organize what exists in products, patents, and markets. In innovation, standardization makes innovation easier, helps to create new products and to organize what exists, a basic factor in innovation.

Open systems interconnection (OSI) is intended as an international standard. Considerable effort is required to achieve results. Results are put in a complete form and validated at a worldwide level. It facilitates the work of researchers in designing methods and equipment.

Factors that contribute to innovation include test methods, records of progress, cross fertilization, iteration between the researchers, and standards bodies.

The role of standards in patents is to concentrate and protect property rights and to offer support without entering into the patent domain.

In considering the relationship between standards and the market, it is well to realize that reference to standards has recently become more important in marketing than ever before. There is a strong inclination in Europe toward European standards. These standards require definition and methods for testing. New products can be developed in parallel with new test procedures.

Standards also play an important role in technology transfer. But standards can only be effective if circulated widely among countries and companies. Standards meet their proper objective through their characteristics and their exploitability.

The Community's objective to strengthen its technology on the world scene can only be effective if the concept of standards is accepted on a wide scale.

### Brief Review of Materials Development and Application

H. Czichos, B.A.M., Germany.

Materials development and application is the basis for improving products. The several R&D routes for materials development are

- Improve materials microstructure
- Optimize manufacturing and processing
- Control materials manufacturing sensor *in situ*
- Improve quality and performance
- Provide materials for information technology and photonics.

Much of the research has taken the traditional approach in studying materials structure, properties, and relations.

An approach of the future will emphasize processing, properties, and performance. In technology, just-in-time production methods have come into favor together with faultless components, in-situ online control, and objective of 100 percent quality and reliability.

The market is now demanding flexible small unit production and also new mass production strategies for 1992.

### Brief Review of Product Assurance Technologies

B. Koch, Svejge Centralen, Denmark.

The projects can be broken down into assuring quality, fiber optic sensors, and need for sensors. Assuring quality includes

- Understand materials better
- Use sensors
- Measure acceleration, gas concentration, gas flow, liquid level, magnetic field, position, pressure, rotation, and temperature.

The need for sensors is apparent in

- Nuclear power plants for uranium enrichment
- Electric power substations
- Chemical and petroleum industry
- Oil and gas refineries
- Offshore and onshore oil and gas production platforms
- Cryogenic liquid storage
- Testing centers
- Automated factories.

As concrete structures deteriorate, the cost of maintenance rises enormously. The dynamic properties of the structures are changed.

Computer aided engineering (CAE) requires the development of computer software to support the work. An important objective is *user friendliness*.

In conclusion, the BRITE-EURAM work on product assurance technologies is at the forefront of research.

### Brief Review of Applications of Manufacturing Systems

L. van Noordgate, WTCM-CRIF, Belgium.

Project length in this area ranges from less than 1 year to 3 years. They cover a range including textiles and composite materials In textiles, projects cover

- Optimized manufacture of yarns, acrylics, and 2-D and 3-D garment modeling
- Optimized techniques in spinning acrylic fibers
- Material handling in the garment industry

Computer aided design in the garment industry

- In the composite materials there are projects in
- Process automation; e.g., aircraft fuselage manufacture
- Ceramic coatings for cutting tools
- Reliable technology the building industry
- Laser processing of thick metal sections over long distances, including monitor and control.

As a general conclusion, the selection of project was a real value for European industry. Transnational cooperation leads to better understanding and concrete results.

## Plenary Session

### The BRITE-EURAM Program

W. Van der Eijk, Directorae General XII, European Commission and others.

BRITE-EURAM is a Community program of support for collaborative industrial research from 1989-1992, with a budget of 440 million ECUs. The main objective of BRITE-EURAM is to make European manufacturing industries more competitive in world markets.

There are priority themes in four main technical areas – advanced materials technologies, design methodology and assurance for products and processes, applications of manufacturing technologies, and technologies for manufacturing processes.

- Advanced Materials Technologies
  * Subarea 1 - Metallic materials and metallic matrix composites
  * Subarea 2 - Magnetic, optical, electrical, and superconducting application
  * Subarea 4 - Polymers and organic matrix composites
  * Subarea 5 - Matrials for specialized applications; e.g., biomaterials, packaging materials, civil engineering materials
- Design Methodology and Assurance for Products and Processes
  * Subarea 1 - Quality, reliability, maintainability
  * Subarea 2 - Process and product assurance
- Applications of Manufacturing Technology
  * Subarea 1 - Advancing manufacturing practices for specialized industrial purposes
  * Subarea 2 - Manufacturing processes for flexible materials such as clothing and footwear, and the food and packaging industries
- Technologies for Manufacturing Processes
  * Subarea 1 - Surface techniques
  * Subarea 2 - Shaping, assembling, and joining
  * Subarea 3 - Chemical processes
  * Subarea 4 - Particle and powder processes

BRITE-EURAM builds on the earlier work of BRITE and EURAM. These programs already support 300 projects. For 1985-1988, BRITE had Community funding of 185 million ECUs and supported 215 projects. For 1986-1989, EURAM has 30 million ECUs and supports 84 projects.